NASA Procedural Requirements

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Request Notification of Change (NASA Only)

Subject: NASA Radio Frequency (RF) Spectrum Management Manual

Responsible Office: Human Exploration and Operations Mission Directorate

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Chapter 3 RF Allocation and Assignment Process and Procedures

3.1 General

3.1.1 All RF EM spectrum usage by NASA programs, projects, and infrastructure will be pursuant to specific assignments approved by the NASA Spectrum Manager, the AA for HEOMD, or his/her designee under the conditions specified in Section 1.2.

3.1.2 NASA has adopted procedures for requesting frequency assignments and obtaining new frequency allocations in order to effectively implement national and international spectrum management policy. These procedures allow for a thorough coordinated process from identification of Agency program/project needs to national and international recognition of actual frequency band usage.

3.1.3 For the purpose of this NPR, the terms frequency allotment, frequency allocation, and frequency assignment use the definitions adopted from the ITU Radio Regulations (RR) (See Appendix A.)

3.1.4 The frequency assignment process outlined in Figure 3-1 is initiated at the user NASA Center/Facility and results in the issuance by NTIA of a Radio Frequency Authorization (RFA) or Special Temporary Authorization (STA).

3.1.5 If the use is not for a major terrestrial program nor for frequencies to be used for transmissions to and from space, the frequency assignment process is fairly simple as described in paragraph 3.3.b (2).

3.1.6 However, for major new programs or for programs involving spacecraft, NTIA has established a systems review process, for the purpose of certification of spectrum support, by which that use is coordinated within the United States and internationally. This process is described in Appendix G.

3.1.7 The Center/Facility SM shall apprise the contractor(s)/grantee(s) of the need for ensuring that radio frequency support appears feasible for NASA-funded studies or Federal-funded equipment procurements by non-Federal interests, where the use of radio frequencies is foreseen as a result of the study or procurement, Section 3.5 provides additional information.

3.2 Frequency Allocations

3.2.1 In almost all cases, identification of RF EM spectrum support for NASA needs is focused on frequency bands currently allocated nationally and internationally for the particular radio service for which the Agency requires support. This includes both terrestrial use (e.g. fixed, mobile, radiolocation, radionavigation and other terrestrial radio service allocations) and space use (e.g., space research service allocations that support the U.S. space programs). However, in some cases, it may be necessary to move Agency operations elsewhere in the RF EM spectrum where appropriate allocations do not currently exist, particularly as new scientific, technological, and commercial requirements emerge and bands in the existing RF allocations become congested. As shown in Figure 3-1, the

identification of the need for a new allocation may be made by reference to the Table of Frequency Allocations or as a result of the systems review process, which includes a study of current frequency band occupancy.

3.2.2 In cases where new frequency allocations are deemed necessary, it is imperative that very long-lead-times (i.e., ten years or longer) be allowed for the national and international processes which are required for new allocations. World Radio Conferences (WRCs) review, and if necessary, revise the Radio Regulations. WRCs meet on a periodic basis (i.e., normally every three-four years). It is essential that NASA is prepared to identify new requirements well in advance of these conferences so that supporting technical and regulatory information can be prepared and presented.

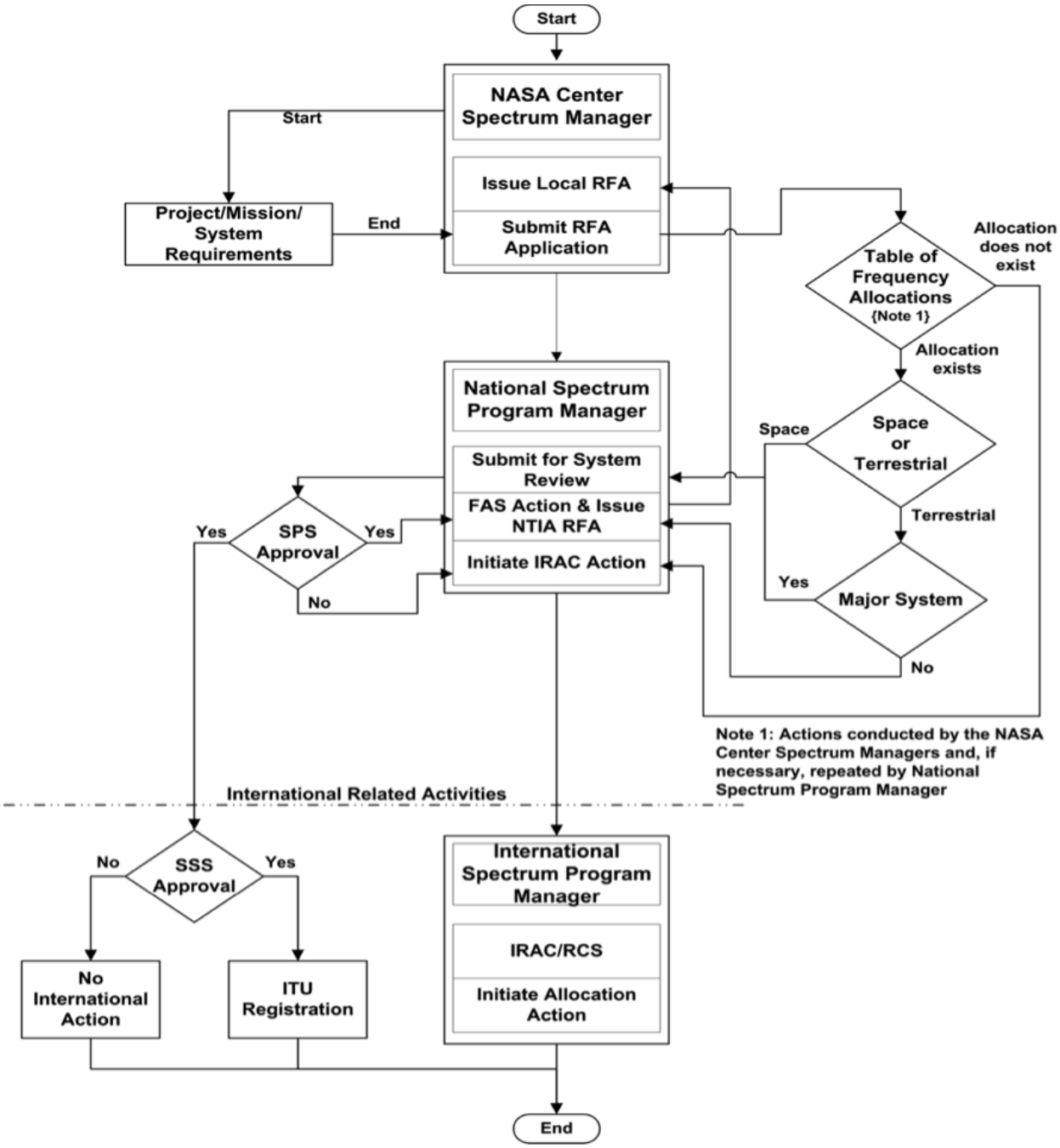

Figure 3-1 Frequency Authorization Process

3.3 Frequency Assignment Process

3.3.1 General

a. Specific procedures by which Agency users may be authorized to operate on a particular frequency depend upon the following factors:

(1) Availability of frequency allocation.

(2) System is terrestrial or spaceborne.

(3) System is considered a major telecommunications system, e.g., high investment.

(4) Duration of the system's operation.

Note: Using OMB regulations, the Center/Facility Spectrum Manager is responsible to ensure that the project completes and submits an economic cost/benefit analysis for each new frequency required. This analysis is done once for NTIA Spectrum Planning Subcommittee (SPS) Stage 2 certification (or at Stage 3 certification, if applicable).

3.3.2 Process for Frequency Selection

a. The process for frequency selection prior to design commitment is outlined below and in Figure 3.2.

(1) Project Commitment (Funding Approved) - Providing project commitment information is key to the successful coordination of design decisions involving the selection of frequencies for systems. An economic analysis justifying the need for the specific frequency and bandwidth is required by OMB Circular A-11. The project/program office has the responsibility to submit this analysis to NTIA SPS during system certification.

(2) Initial Frequency Coordination Guidance - Due to the increasing complexity and usage of the RF spectrum, the availability/cost [8] of spectrum may actually drive the design requirements for future NASA missions. Each Center has a designated Radio Frequency Spectrum Manager who is responsible for obtaining, maintaining, and retiring the RFA for programs, projects, and infrastructure at the Center; and for preventing or mitigating radio frequency interference at the Center or to the Center's programs, projects, and infrastructure. The Center Radio Frequency Spectrum Manager provides guidance on the selection of properly allocated frequency bands to fulfill mission requirements. Once candidate frequency bands and Center frequencies are selected, the dissemination of the information is necessary to ensure that appropriate feedback is obtained to ensure timely resolution of problems from within NASA, as well as with other users of the spectrum.

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[8] Spectrum fees are being considered but, as of the publication date, have not been established.

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(3) Dissemination of Candidate Frequencies - Parties who should receive information about candidate frequencies include the relevant NASA Spectrum Managers at the Center/Facility level and the candidate Government or commercial launch sites that NASA may use in the future. The Center/Facility Spectrum Manager shall send the SPS submissions to the National Spectrum Program Manager, NASA's SPS representative, and alternate SPS representatives. This ensures that the NTIA's SPS concerns are addressed before the submission of a request for certification of spectrum support. Spectrum Managers may also provide additional insight into scheduling issues for frequencies in highly congested bands requiring ground station support.

(4) Comments and Analysis of Frequencies - Projects should employ an approach similar to the RF analysis of the candidate frequencies. Therefore, projects should be prepared to fund an RF analysis that may need to be conducted to ensure electromagnetic compatibility with other users of the proposed frequency band(s) of operation. The results of such an analysis should provide additional information for the selection of the best frequency for a particular mission and should be included in a submission to the NTIA for a request for certification of spectrum support.

(5) Initiate Spectrum Planning Subcommittee Process - The conceptual phase of a mission ends when the necessary analysis has determined the best frequency candidate(s) for a particular mission. The planning phase then begins with an initial submission of a request for certification of spectrum support (Stage 1 or 2) to the NTIA. The NTIA may provide further guidance or raise concerns regarding existing systems that may be incompatible with the particular mission. (See Appendix G of this NPR and Chapter 10 of the NTIA's "Manual of Regulations & Procedures for Federal Radio Frequency Management" -- referred to as the NTIA Manual).

b. NASA's SPS representative or alternate SPS representatives shall submit to NTIA all Center/Facilities responses to questions from NTIA during the systems review process in order to ensure that items are tracked.

c. It is mandatory that all Centers/Facilities use NTIA's Equipment Location -- Certification Identification Database (EL-CID) or current successor software program for the generation of the request for certification of spectrum support. The Center/Facility is also responsible for any additional required data to support a request for certification as described in Chapter 10 of the NTIA Manual. [9]

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[9] Spaceborne systems transmitting in the 2200 MHz to 2290 MHz band are limited to bandwidths of no more than 5 MHz (or approximately 6.16 MHz for spread spectrum use for multiple users on the same frequency through TDRS), in accordance with Section 8.2.41 of the NTIA Manual. Justification for a waiver of this policy is required by the NTIA before any system exceeding this constraint can be certified

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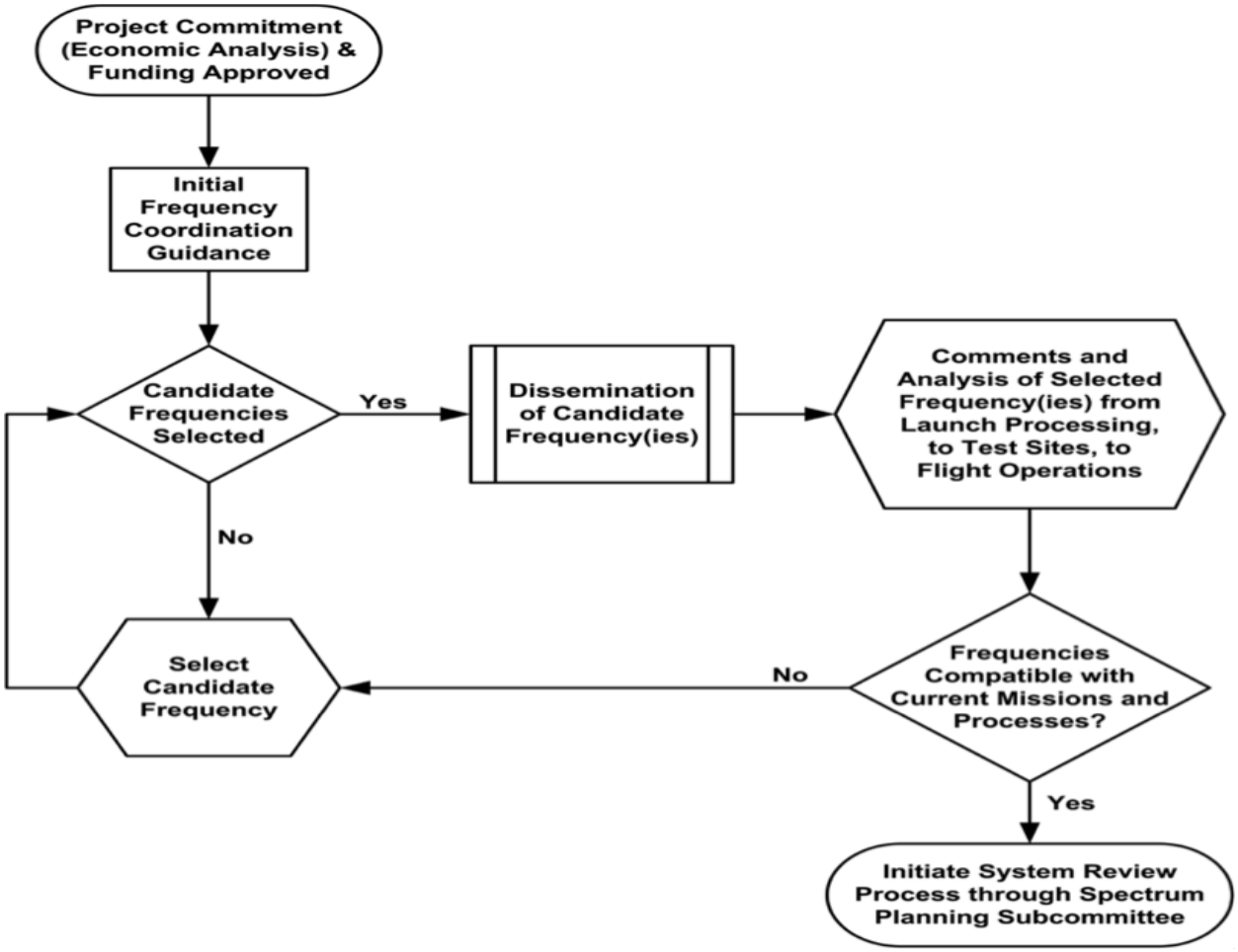

Figure 3-2 Frequency Selection Process

3.3.3 Terrestrial Assignments

a. Some terrestrial systems may be classified as major telecommunications systems. These are systems which, even though spectrum allocations currently exist, are required to be submitted to NTIA for certification of spectrum support because they have large bandwidth requirements, new modulation techniques, novel applications, or are considered to have a significant impact on the existing electromagnetic environment. (See Appendix G.).

b. NASA users requiring assignments for radio frequencies for non-major terrestrial use will provide the specific technical information to the Center/Facility Spectrum Manager. This information is submitted for all frequency assignment actions by the appropriate NASA Center/Facility Spectrum Manager to the NASA FAS representative utilizing the NTIA automated processing system to request and receive radio-frequency assignments.

c. The following procedures and notes will aid NASA spectrum applicants, from missions/programs/projects, in the preparation of their applications for frequency assignments and facilitate the processing of the applications:

(1) Step 1: From the operational requirements, determine the specific frequency or band of frequencies, together with alternate frequencies that would be acceptable if the desired frequencies are not available. Allow a lead-time of at least 60 work days for processing of typical land mobile radio operations and up to 180 work days for complex systems requiring pre-coordination with other Federal agencies. The process time commences when the application appears on the FAS electronic agenda.

(2) Step 2: The Center/Facility Spectrum Manager will ensure that the frequencies are available and are in accordance with the National Table of Frequency Allocations. (Do not request "out-of-band" frequency assignments or allocations unless absolutely necessary and with written justification). In cases where out-of-band frequencies must be used, allow the maximum lead-time possible (240 days).

(3) Step 3: Refer to Section 3.4 of this NPR to determine if coordination with other users of the spectrum is required. The type and amount of coordination that might be required varies with the specific frequencies and applications involved. When such coordination is extensive, the user (applicant) provides funds for such coordination, including the preparation of coordination contour charts.

(4) Step 4: For each frequency assignment action required, submit the information to the NASA Center/Facility Spectrum Manager together with any other information that will aid in expediting the application.

d. NASA Center/Facility Spectrum Managers and/or JPL, a Federally Funded Research and Development Center (FFRDC), Spectrum Manager are responsible for processing the information into the proper NTIA computer mnemonic format. For short term uses of RF equipment (i.e., 30 days or less), the Center/Facility Spectrum Manager may determine that only a Special Temporary Authority (STA) is required. Submit this data via the NTIA automated processing system to the NASA FAS representative. Short-term use of greater than 30 days may be granted through a temporary RF authorization. Additionally, for short or intermittent experimental activities conducted within the immediate vicinity of a station, the Center/Facility may provide, on a case-by-case basis, local authorization for certain transmissions in accordance with Section 7.11 of the NTIA Manual.

e. Submission of data or acknowledged receipt does not constitute a frequency assignment or authorization regardless of any verbal agreements or understandings between the applicant and NASA spectrum management personnel. Do not attempt to operate on the frequency requested or to purchase equipment requiring such frequency support until authorized by formal RFA or STA issued through the Center/Facility Spectrum Manager.

3.3.4 Space Assignments

a. Chapter 10 of the NTIA Manual entitled, "Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC) and Telecommunications Service Priority for Radio communications (TSP-R)" states that, for Government agencies, the SPS review process is applicable to certain systems and subsystems. Furthermore, space systems are governed by both the U.S. interagency process (SPS review) and ITU requirements (notification/coordination through the SSS). The systems review is a procedure used by the SPS to develop recommendations, on behalf of the IRAC, for the Deputy Associate Administrator, Office of Spectrum Management of NTIA, regarding certification of spectrum support for telecommunication systems or subsystems. This review provides an early awareness in the regulatory community and allows for either early support or early identification of potential problems in the future. A system can be reviewed at four stages as it matures into an operational status. These are:

(1) Stage 1. Conceptual

(2) Stage 2. Experimental

(3) Stage 3. Developmental

(4) Stage 4. Operational

c. The SPS Systems Review is intended for:

(1) New telecommunication systems or subsystems and major modifications to existing systems or subsystems, involving the use of satellites or spacecraft.

(2) New major terrestrial systems or subsystems and major modifications to existing systems or subsystems.

(3) Other systems or facilities as may be referred to the SPS on a case-by-case basis. [10]

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[10] Telemetry, tracking, and control for spaceborne systems require a Stage 4 (Operational) certification of spectrum support (from NTIA) before any spaceborne system is launched (even if the spaceborne system is experimental).

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d. This review process is mandatory for space systems except those that operate under Appendix K of the NTIA Manual regarding low-power non-licensed devices. For those systems which require review by the SPS and certification by the NTIA, the Center/Facility Spectrum Manager shall be required to coordinate with the NASA SPS representative throughout the review process.

e. Systems that are intended to operate in space will be submitted to the ITU in order to meet the requirements for Advance Publication, Coordination, and Notification as necessary under Articles 9 and 11 of the ITU Radio Regulations. The SSS representative shall use the information provided for certification by NTIA to generate the submission(s) to the ITU and will work closely with the Center/Facility Spectrum Manager to collect any additional information that may be required. The Center/Facility Spectrum Manager may request a waiver from the NTIA's SSS of the requirement to file the ITU notification, provided that the space system operates for less than one year. [11]

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[11] Area coordinators are found in the NTIA Manual.

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f. Details of the Systems Review procedure can be found in Appendix G.

3.4 U.S. Coordination Requirements

3.4.1 NASA Components as Tenants at Other Government Agencies

NASA Centers/Facilities having joint tenant status at other Government agencies will coordinate frequency

requirements with the host Government agency as required. Applications are then forwarded to the NASA FAS Representative reflecting the recommendations of the host Agency under whose jurisdiction the operation is proposed.

3.4.2 Joint Radio Frequency Coordination for National Test Ranges

a. The Department of Defense (DoD) has established a system of military interservice frequency coordination to minimize interference and to avoid conflict with or among radio and electronic operations at the DoD National Test Ranges. This system requires that certain frequencies be coordinated with DoD Area Frequency Coordinators (AFC) prior to the issuance of assignments. In the interest of economy and compatibility of operations, this system of coordination is used by NASA, in accordance with the joint DoD-NASA Agreement. [12]

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[12] The areas in which Military Interservice Frequency Coordination is required are shown in Table 8.3.26 of the NTIA Manual. Table 8.3.26 also lists the DoD AFC responsible for coordination within each area.

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b. DoD AFC maintain current records of frequencies that have been coordinated for use in their area of cognizance. Upon request for frequency coordination, they supply technical comments on the probability of harmful interference being caused or received by the proposed operations.

c. All frequencies intended for use within the National Test Ranges (or within those areas delineated in Table 8.3.26 of the NTIA Manual) which are considered capable of causing harmful interference to operations at the specified test ranges, including any extended established "down-range" areas, are coordinated with the responsible DoD AFC. Area frequency coordination is accomplished by the Spectrum Manager of the NASA Center in accordance with the following procedures:

(1) Step 1: When NASA operations require DoD range support and are to be conducted at sites under military cognizance, select the use of the frequencies required in coordination with the AFC of the range concerned. In the case of those military test facilities where there is no resident AFC, coordinate NASA frequency usage with the local Military Frequency Manager who will, in turn, effect the necessary coordination with the cognizant AFC.

(2) Step 2: If the frequencies required are already assigned for use at the range concerned, the AFC (or local Military Frequency Manager) will effect local authorization and interference protection as necessary. When the frequencies required are not assigned to the range, the AFC will request assignment from the military department having cognizance of that range.

(3) Step 3: Where NASA operations are to be conducted at sites not under military cognizance, but within the area defined in Table 8.3.26 of the NTIA Manual, coordinate the use with the AFC of the range concerned by providing system/emission characteristics for this purpose. The AFC will comment with due regard to all military frequency usage within the area involved.

(4) Step 4: Forward system/emission characteristics in accordance with Chapter 9 of the NTIA Manual to the NASA FAS representative for coordination with other users and IRAC. Include a memorandum stating that coordination has been effected with the AFC involved. The NASA FAS representative will apply for the assignments to cover these operations.

(5) Step 5: Should a frequency conflict arise between the DoD AFC and NASA Center/Facility Spectrum Managers and/or JPL (an FFRDC), Spectrum Manager that cannot be resolved satisfactorily through measures acceptable to the Center involved, forward a complete and detailed report to the National Spectrum Program Manager and the NASA FAS representative who will attempt to resolve the conflict at the Agency level.

3.4.3 Coordination Procedures for the National Radio Quiet Zone (NRQZ)

a. The NRQZ is an area approximately 13,000 square miles set aside for radio astronomy observations. This area is bounded by 39°15'N on the North, 78°30'W on the East, 37°30'N on the South and 80°30'W on the West.

b. To protect the NRQZ from interference, the following criteria have been established:

(1) Based on a 20 kHz measurement bandwidth, the calculated power density of the transmitter at the reference point should be less than:

(a) 1 x 10-8 W/m2 for frequencies below 54 MHz.

(b) 1 x 10-12 W/m2 for frequencies from 54 MHz to 108 MHz.

(c) 1 x 10-14 W/m2 for frequencies from 108 MHz to 470 MHz.

(d) 1 x 10-17 W/m2 for frequencies from 470 MHz to 1000 MHz.

(e) freq2 (in GHz) x 10-17 W/m2 for frequencies above 1000 MHz.

(f) Except for frequencies that reside in the radio astronomy observing bands, in which case the power densities

listed in Recommendation ITU-R RA.769-2 will apply. The reference point is located at 38°25' 59.2" N, 79°50' 23.4" W at 2,644 feet (806 meters) above mean sea level at a height of 458 feet above ground level. [13]

[13] For detailed information on the NRQZ, please see http://www.gb.nrao.edu/nrqz/nrqz.shtml For coordination questions, contact the NRAO Interference Office at 304-456-2107.

c. All proposed frequency assignments to NASA radio stations within the NRQZ are coordinated by the NASA FAS representative per the NTIA Manual Part 8.3.9, prior to authorization.

3.4.4 Coordination Procedures with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC)

a. Coordination procedures are applicable for all frequency assignment actions for use of frequencies in the bands 1435-1525 MHz, 2310-2320 MHz, and 2345-2390 MHz by U.S. Government radio stations within the conterminous United States and are implemented to minimize, through local selection of frequencies and effective coordination, the possibility of interference.

b. All proposed and renewal frequency applications for NASA radio stations shall include an AFTRCC concurrence number obtained in accordance with the NTIA Manual Chapter 8.3.17 and Annex D of the NTIA Manual.

3.5 NASA Contractors and Grantees

3.5.1 Applications Required for Contractors and Grantees

If a NASA contractor or grantee requires the use of radio frequencies under the terms of a NASA contract/grant and the contract/grant does not explicitly address control of the transmitting equipment, a determination will be made by the Center SM in consultation with the National Spectrum Program Manager as to whether NASA should apply to the NTIA for the frequency authorization or whether the contractor/grantee should apply to the FCC. The determination is based upon whether the radio station "belongs to and is operated by" the Federal agency or the contractor. The NTIA and FCC provide guidance for such determinations, and all NASA contractors and grantees should work with the appropriate Center Spectrum Manager in making that determination.

3.5.2 Non-NASA Owned and Operated

For NASA-funded but non-Federal designated systems, NASA requires that the contractor or grantee obtain spectrum licensing through the appropriate FCC processes. Appropriate language should be included in the contract, grant, or agreement documents (e.g., contracts, cooperative research and development agreements (CRADAs), etc.).

3.5.3 NASA Owned and Operated

a. The Center/Facility Spectrum Manager shall provide to the contracting officer such technical assistance as may be required to enable the issuance of a radio frequency assignment.

b. Contractors, providing or operating RF equipment for NASA use, will obtain RF EM spectrum authorization in accordance with the terms of the contract through the NASA contracting officer. Contractors desiring to use Federal spectrum, as specified in the NTIA table of allocations (Chapter 4), are required to submit their needs to the Center/Facility Spectrum Manager. (The radio frequencies so approved do not belong to the contractor and are only for NASA use. Additionally, NASA will ensure it maintains operational control of the radio equipment, should the need to cease transmissions arise.)

3.6 Foreign Frequency Assignments

Requests for foreign frequency assignments will be provided by the Center/Facility Spectrum Manager responsible for the project to the NASA International Spectrum Program Manager. In the case of frequency assignments to be used in aircraft over foreign territories, the International Spectrum Program Manager works with the Office of International and Interagency Relations (OIIR). In some circumstances, NASA may request cooperating space agencies to obtain frequency assignments.

3.7 Conditions of Assignment

3.7.1 All Center activities will be assigned frequencies by NTIA through the NASA FAS representative. Documentation of approved assignments is available to the Center/Facility Spectrum Managers via the NTIA automated processing system. Based on this authorization, Center/Facility Spectrum Managers may issue Center RFAs.

3.7.2 Additionally, a copy of the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management will also be supplied to all Spectrum Managers. Supplements to this manual will be furnished by the National Spectrum Program Manager when published by the NTIA.

3.7.3 All NASA frequency assignments are issued subject to the following conditions:

a. All frequencies assigned to NASA are issued subject to the conditions stated on the authorization. It is the responsibility of the Center/Facility Spectrum Manager to ensure that expiration dates are valid for their assignments and that, by September of each year, they perform updates via the NTIA automated processing system to any radio frequency assignment due for its five year review.

b. Radio transmitters are operated by adequately trained and designated personnel and in a manner conforming to established and accepted procedures.

c. Transmitter operations are conducted by personnel only on authorized frequencies after an assignment has been granted by the NTIA Frequency Assignment Subcommittee and entered into the Government Master File (GMF) or a Special Temporary Authorization has been granted by NTIA.

d. Approved power, emissions, and conditions of assignments shall be adhered to at all times.

e. All land mobile radio transmissions are identified by the use of the authorized radio call signs pursuant to Appendix H of this NPR.

f. Transmitter operations are held within the prescribed tolerances outlined in Chapter 5 of the NTIA Manual unless otherwise authorized.

g. A copy of the current RFA for each fixed radio station should be posted or retained in some manner at the principal control point of each radio transmitter or station.

h. An RF evaluation should be conducted in accordance with NPR 1800.1C requirements to determine the effects on human health, including interference with personnel operations such as maintenance procedures. Evaluations should be handled at a local level with the Center Radiation Safety Officer and/or Non-Ionizing Radiation Safety Officer and in collaboration with the Center/Facility Spectrum Manager. Local procedures will vary at each site and, as a minimum, follow IEEE C95.1, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields."

3.7.4 Section 7.11 of the NTIA Manual outlines conditions under which specific frequency usage may be authorized without prior coordination with other Government agencies. The Center/Facility Spectrum Managers may issue local RFAs without referral to the NASA FAS Representative to cover those operations that meet the criteria established in this chapter of the NTIA Manual for the particular frequency usage involved.

3.7.5 All Ground Penetrating radar and Global Positioning Satellite (GPS) re-radiators shall receive NASA and NTIA approval prior to use (see NTIA Manual, Annex K for Ground Penetrating radars and Sections 8.3.28-8.3.30 for GPS re-radiators).

3.8 Emergency and Wartime Procedures

3.8.1 Emergency Procedures

a. Under a declared emergency condition, Center/Facility Spectrum Managers may use or assign to an operation under their direction, frequencies not otherwise authorized, provided that:

(1) The nature and duration of the requirement are such that the normal frequency assignment procedures are impractical.

(2) All reasonable measures are taken before such frequencies are used to ensure that harmful interference will not be caused to other users.

3.8.2 Wartime Procedures

a. In wartime, all radio frequencies, both Federal and non-Federal, may be under the centralized authority of NTIA. Normally, under such conditions, military operations will take precedence over nonmilitary operations. However, all priorities established by the NTIA take into account all aspects of the President's communications requirements for the national defense in time of war.

b. NASA's role in providing support for these wartime procedures is established through the NTIA by the NASA Director of Spectrum Policy and Planning and will be implemented as required. The specific procedures are beyond the scope or intent of this NPR.

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